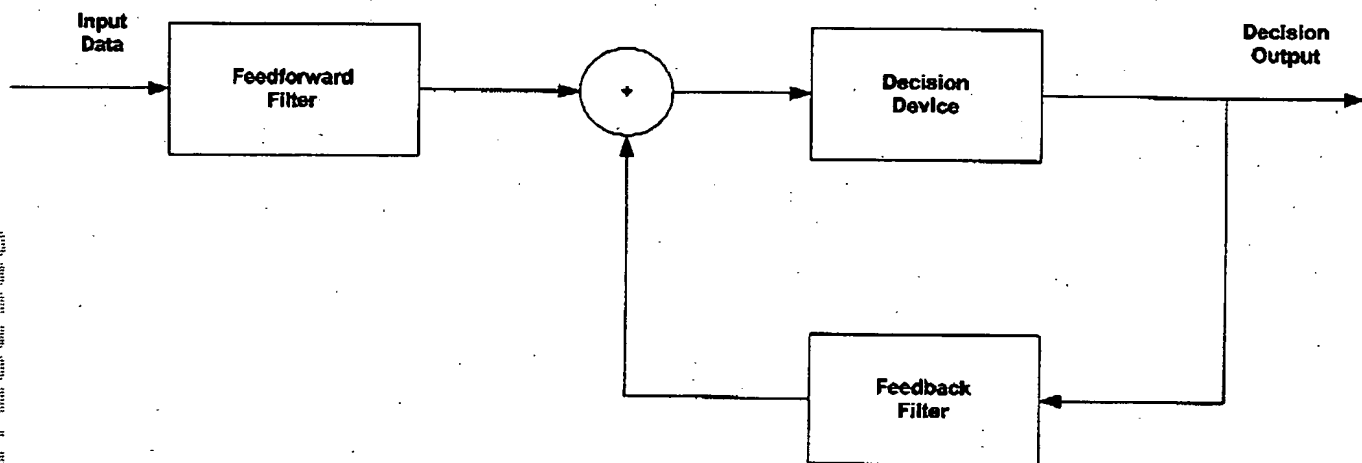


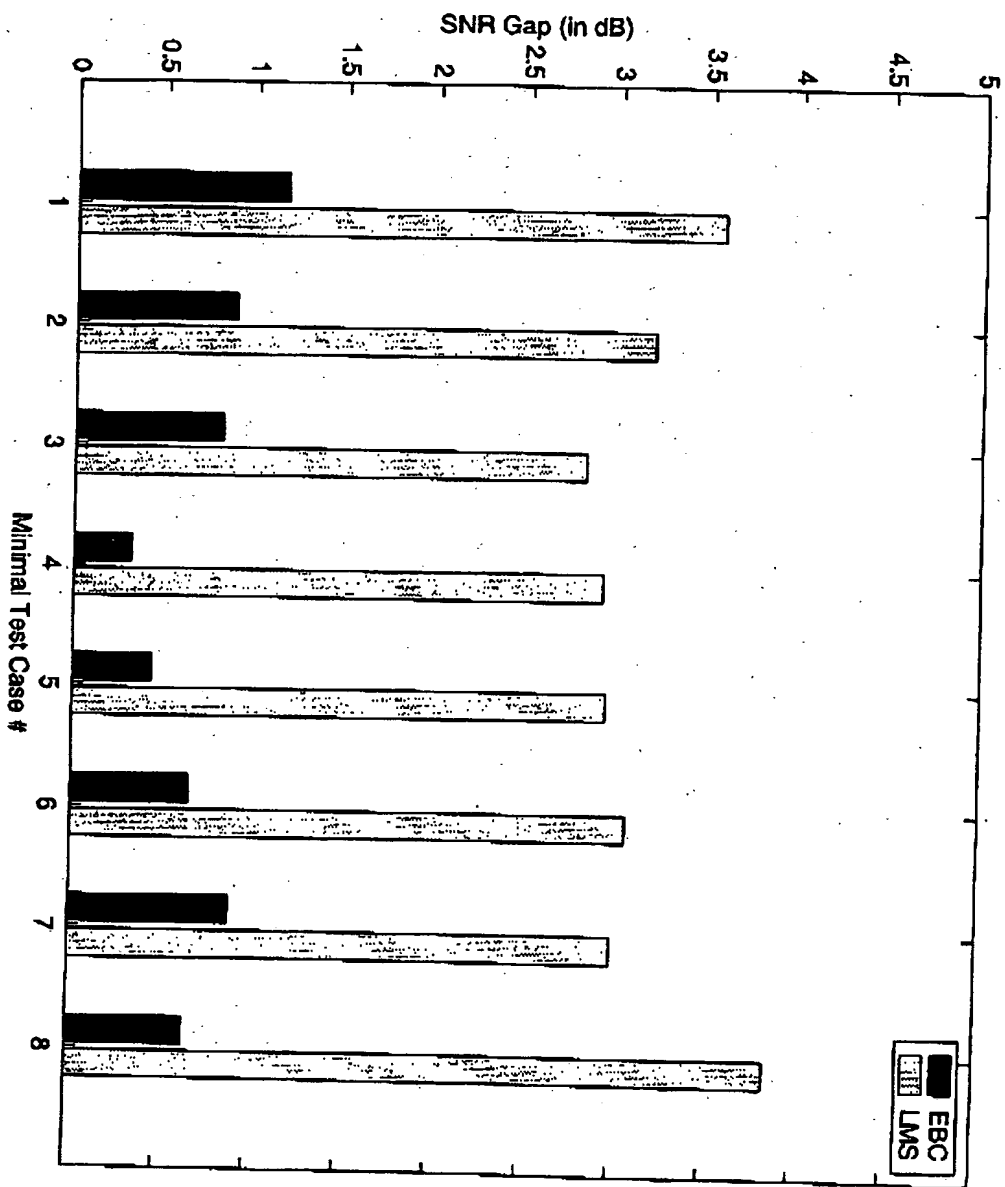
Fig. 1

005780" ST56E960



Decision Feedback Equalizer

Fig 2



3a
Figure 3a: Performance Gap for the HDLS2 Minimal Test Set.

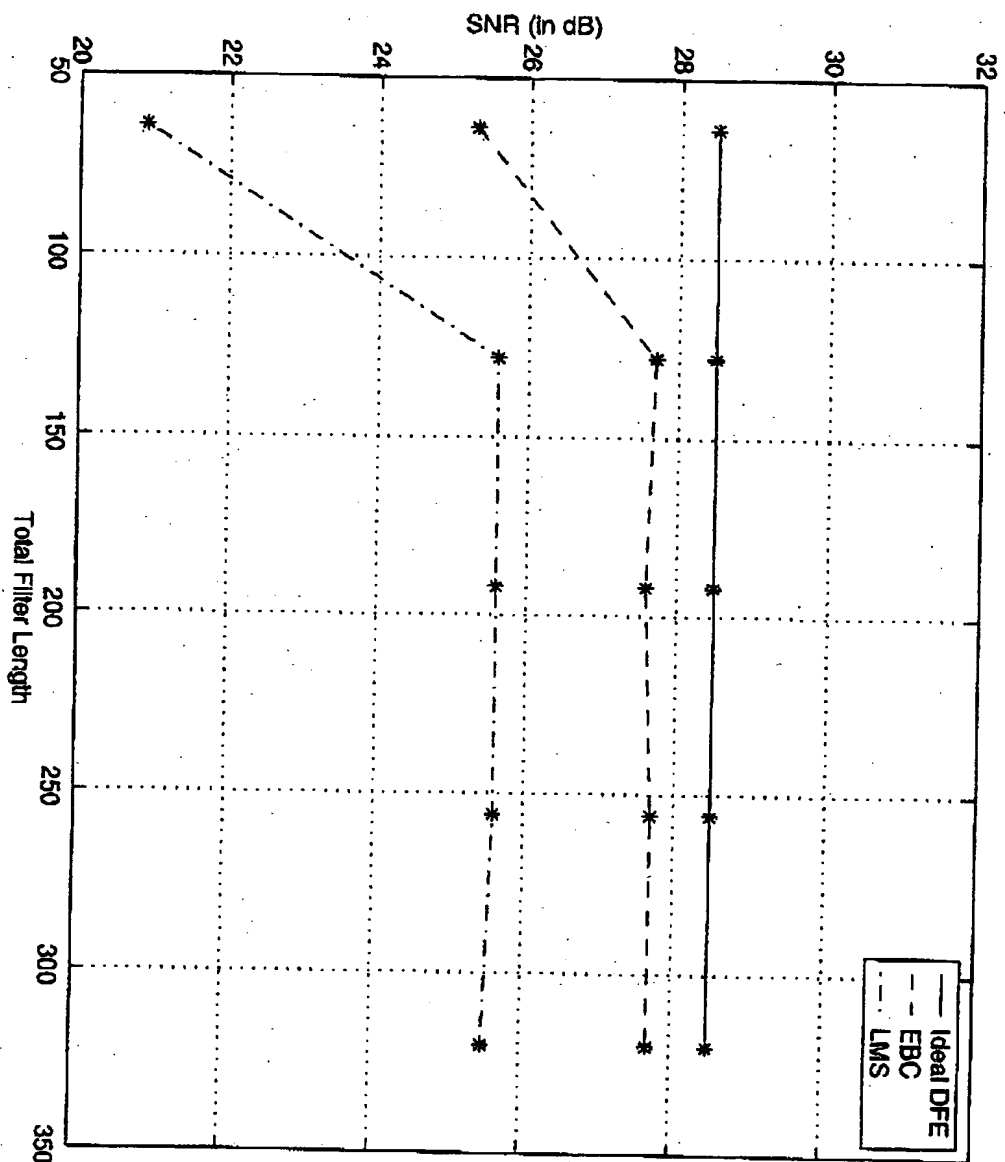
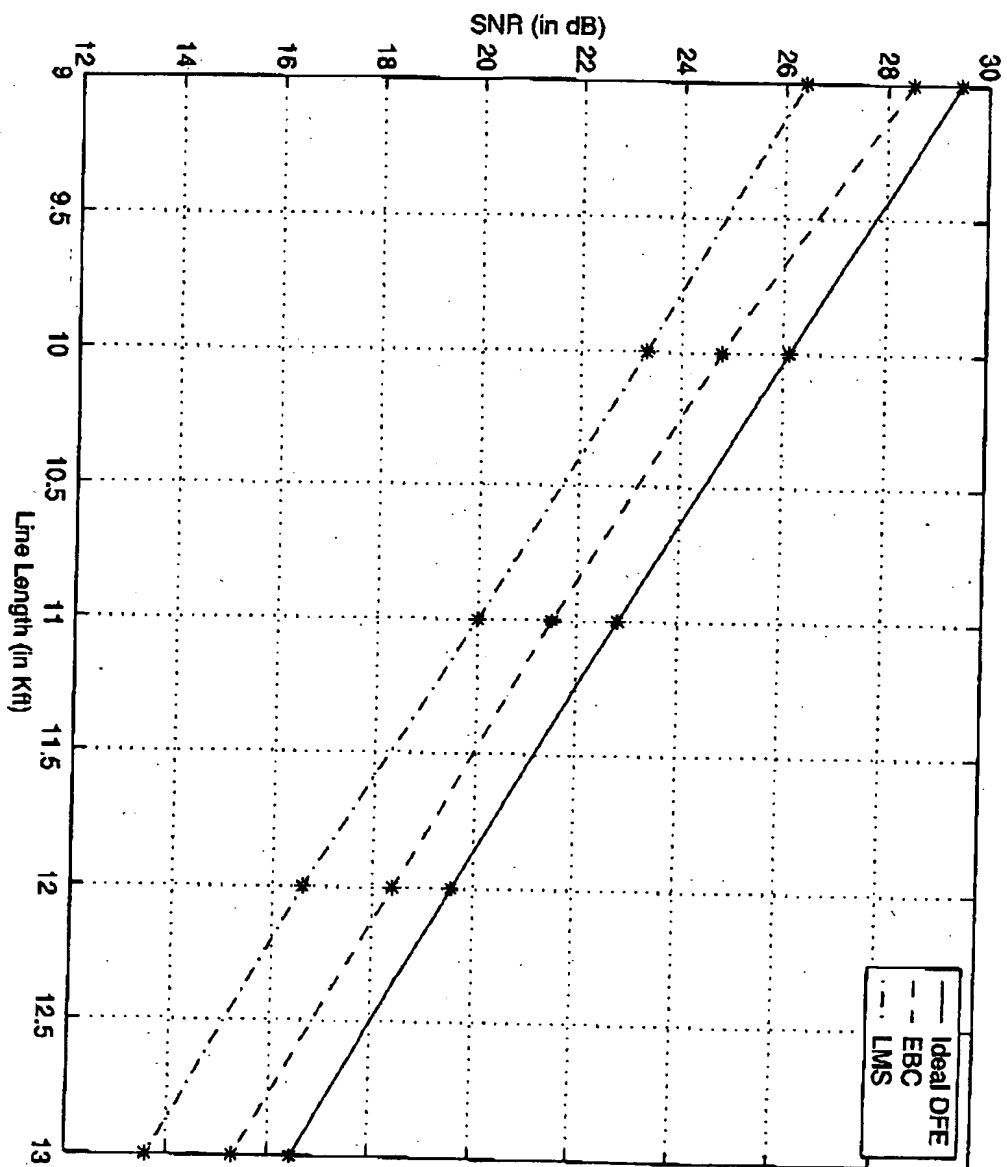


Figure 4: Total Filter Length vs SNR for the Test Case #2.



3c
Figure #: Line Length vs SNR for the Test Case #6.

09639515 081500

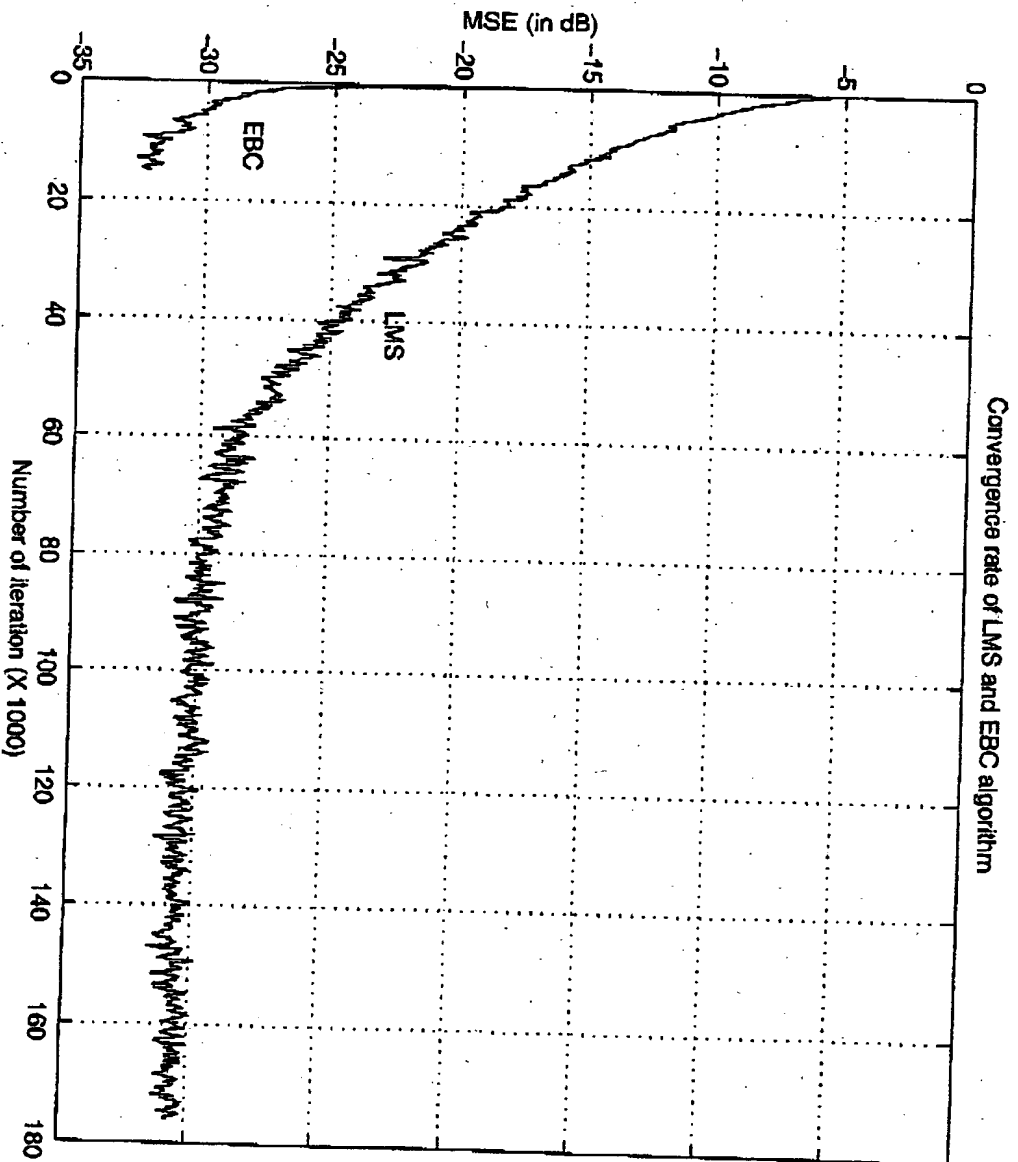


Figure 8: ^{9d} Comparison of convergence of LMS and EBC algorithm

Step	Update Equation	# of Mul
1	$e \leftarrow \text{eps}_2 + A_f^T X_f$	mN
2	$A_f \leftarrow A_f - K_f e e^T$	mN
3	$e_p \leftarrow \text{eps}_2 + A_f^T X_f$	mN
4	$E_f \leftarrow \lambda E_f + e_p e^T$	$2m^2$
5	$b_n \leftarrow K_f + A_f E_f^{-1} e_p$	$m^3 + m^2 + mN$
6	$c_n \leftarrow E_f^{-1} e_p$	m^2
7	$m \leftarrow [c_n(1:2); b_n(1:N_{ff}-2); c_n(3); b_n(N_{ff}+1:N-1)]$	0
8	$\mu \leftarrow [b_n(N_{ff}-1:N_{ff}); b_n(N)]$	0
9	$X_f \leftarrow [\text{eps}_2(1:2); X_f(1:N_{ff}-2); \text{eps}_2(3); X_f(N_{ff}+1:N-1)]$	0
10	$\eta \leftarrow p_3 + D_f^T X_f$	mN
11	$D_f \leftarrow (D_f - m\eta^T)(I - \mu\eta^T)^{-1}$	$m^2(N+1) + m^3 + mN$
12	$K_f \leftarrow m - D_f^T \mu$	mN
13	$x_{est} \leftarrow C_f X_f$	N
14	$\text{error} \leftarrow \text{decision} - x_{est}$	0
15	$C_f \leftarrow C_f + \text{error} K_f$	N
Total complexity		$(m^2 + 7m + 2)N + 5m^2 + 2m^3$

Table 1: Update equations and complexity of the original RLS fast algorithm.

Fig 4

09039515, 031500

Step	Update Equation	# of Mul
1	$e \leftarrow eps_2 + A_f^T X_f$	mN
2	$A_f \leftarrow A_f - K_f e^T$	mN
3	$e_p \leftarrow e(1 - K_f^T X_f)$	$N + m$
4	$F_f \leftarrow \lambda F_f$	m^2
5	$c_n \leftarrow F_f 1 + e_p^T F_f e_p$	$2m(m + 1)$
6	$F_f \leftarrow F_f - c_n e^T F_f$	$m(m + 1)$
7	$b_n \leftarrow K_f + A_f c_n$	mN
8	$m \leftarrow [c_n(1 : 2); b_n(1 : N_{ff} - 2); t_3(3); b_n(N_{ff} + 1 : N - 1)]$	0
9	$\mu \leftarrow [b_n(N_{ff} - 1 : N_{ff}); b_n(N)]$	0
10	$X_f \leftarrow [eps_2(1 : 2); X_f(1 : N_{ff} - 2); eps_2(3); X_f(N_{ff} + 1 : N - 1)]$	0
11	$\eta \leftarrow p_3 + D_f^T X_f$	mN
12	$K_f \leftarrow (m - (D_f \mu)) / (1 - \eta^T \mu)$	$(m + 1)N + m$
13	$D_f \leftarrow D_f - K_f \eta^T$	mN
14	$x_{est} \leftarrow C_f X_f$	N
15	$error \leftarrow decision - x_{est}$	0
16	$C_f \leftarrow C_f + error K_f$	N
Total complexity		$(6m + 4)N + 4m^2 + 5m$

Fig 5

005780" 5T56E960

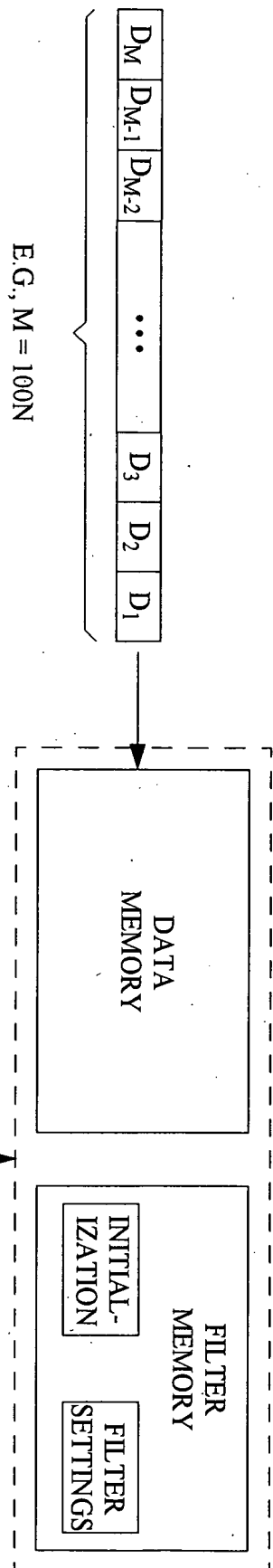


Fig. 6
(Prior Art)

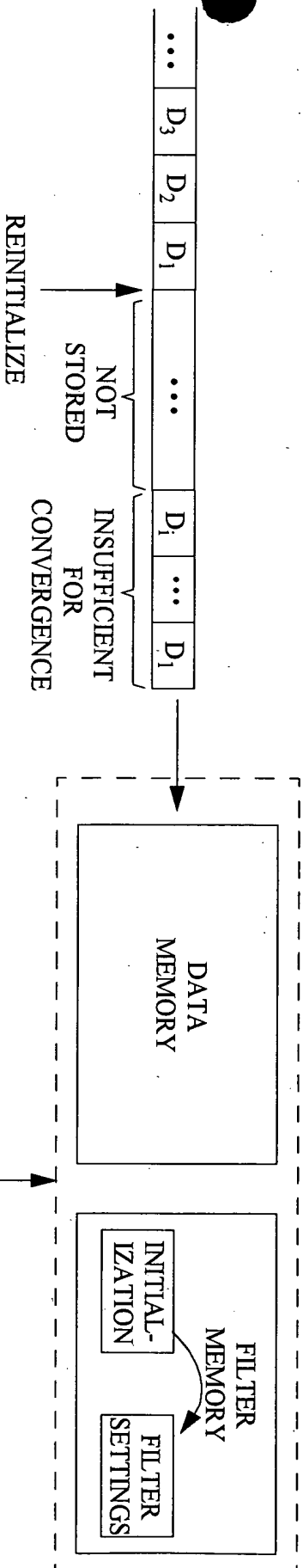
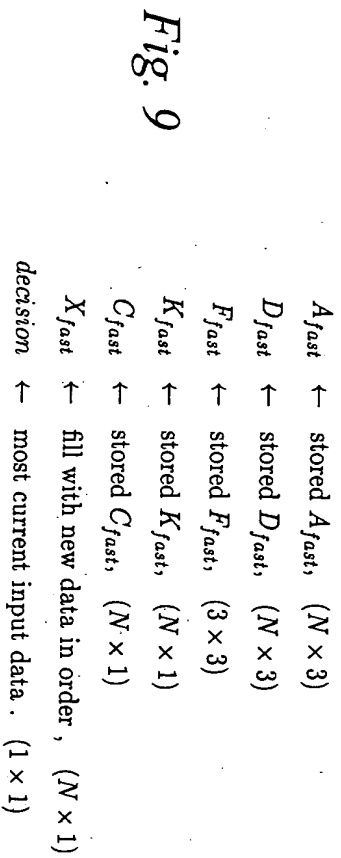
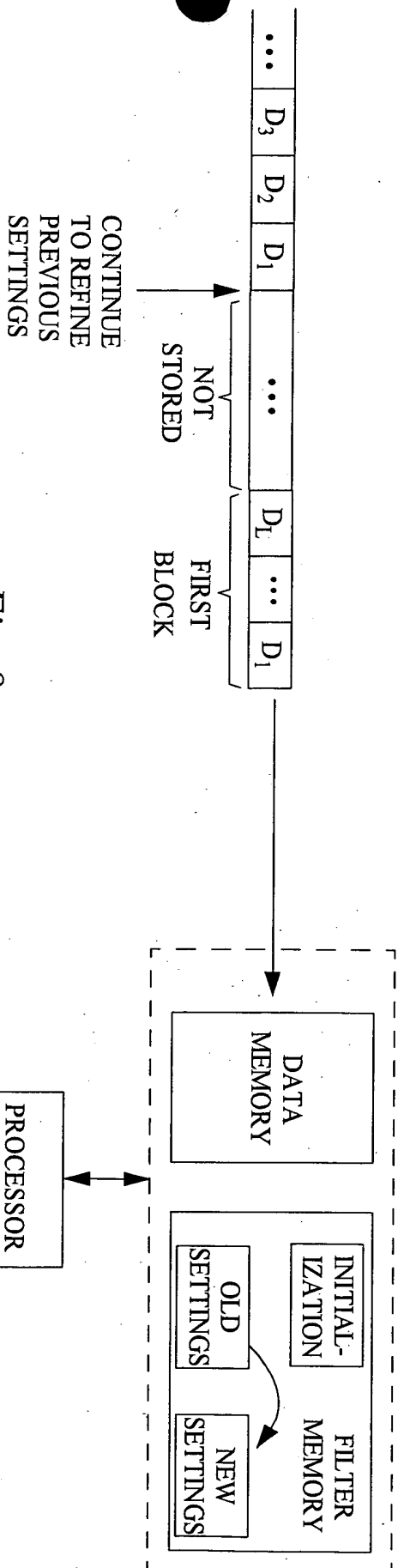


Fig. 7
(Prior Art)



```
graph TD
    subgraph Left_Side [ ]
        direction TB
        L1[Train PLL] --> L2{Lock?}
        L2 -- No --> L1
        L2 -- Yes --> L3[Train Echo Canceller]
        L3 -- No --> L3
        L3 -- Yes --> L4{SNR > SNR_1}
        L4 -- No --> L3
        L4 -- Yes --> L5[Train Equalizer]
        L5 -- No --> L5
        L5 -- Yes --> L6{MSE < MSE_1}
        L6 -- No --> L5
        L6 -- Yes --> L7[Train PLL]
        L7 -- No --> L7
        L7 -- Yes --> L8{Zitter < tol_1}
        L8 -- No --> L7
        L8 -- Yes --> L9[Train Echo Canceller]
        L9 -- No --> L9
        L9 -- Yes --> L10{SNR > SNR_2}
        L10 -- No --> L9
        L10 -- Yes --> Right_Side
    end

    subgraph Right_Side [ ]
        direction TB
        R1[Train PLL] --> R2{Zitter < tol_2}
        R2 -- No --> R1
        R2 -- Yes --> R3[Train Echo Canceller]
        R3 -- No --> R3
        R3 -- Yes --> R4{SNR > SNR_3}
        R4 -- No --> R3
        R4 -- Yes --> R5[Train Equalizer]
        R5 -- No --> R5
        R5 -- Yes --> R6{MSE < MSE_2}
        R6 -- No --> R5
        R6 -- Yes --> R7[Train Echo Canceller]
        R7 -- No --> R7
        R7 -- Yes --> R8{SNR > SNR_final}
        R8 -- No --> R7
        R8 -- Yes --> R9[Train Equalizer]
        R9 -- No --> R9
        R9 -- Yes --> R10{MSE < MSE_final}
        R10 -- No --> R9
        R10 -- Yes --> STOP[STOP]
    end
```

STOP
Fig 10. Cooperative, interdependent training of various subsystems.